

# Munich Cancer Registry



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## ICD-10 C19, C20: Rectal cancer

### Survival

Year of diagnosis	1988-1997	1998-2019
Patients	3,825	20,485
Diseases	3,827	20,512
Cases evaluated	3,442	16,455
Creation date	01/27/2021	
Database export	01/07/2021	
Population	4.92 m	



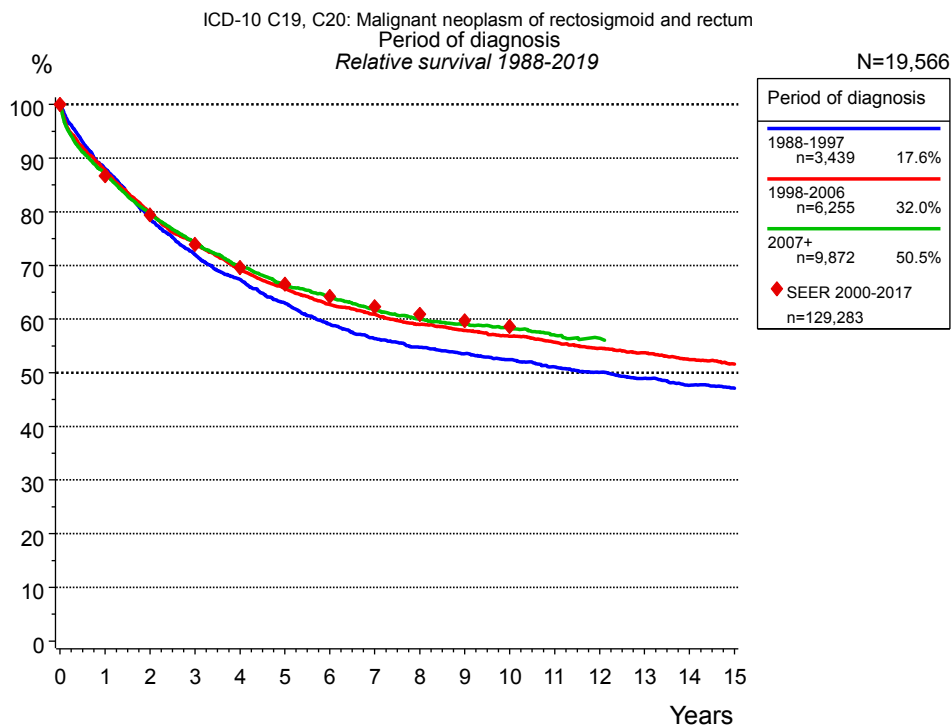
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<https://www.tumorregister-muenchen.de/en>

<https://www.tumorregister-muenchen.de/en/facts/surv/sC1920E-ICD-10-C19-C20-Rectal-cancer-survival.pdf>

### Index of figures and tables

Fig./Tbl.		Page
1a	Relative survival by period of diagnosis (chart)	3
1b	Survival by period of diagnosis (table)	3
2a	Survival by sex (chart)	4
2b	Survival by sex (table)	4
3a	Observed survival by age category (chart)	5
3b	Relative survival by age category (chart)	5
3c	Survival by age category (table)	6
4a	Relative survival by UICC (chart)	7
4b	Survival by UICC (table)	7
4c	Conditional survival by UICC (chart)	8
4d	Conditional survival by UICC (table)	8
4g	Relative survival by TNM staging (chart)	9
4h	Survival by TNM staging (table)	9
5a	Time to first progression (chart)	11
5b	Time to first progression (table)	11
5c	Observed post-progression survival (chart)	13
5d	Observed post-progression survival (table)	13
5e	Observed post-progression survival by period of progression (chart)	14
5f	Observed post-progression survival by period of progression (table)	14



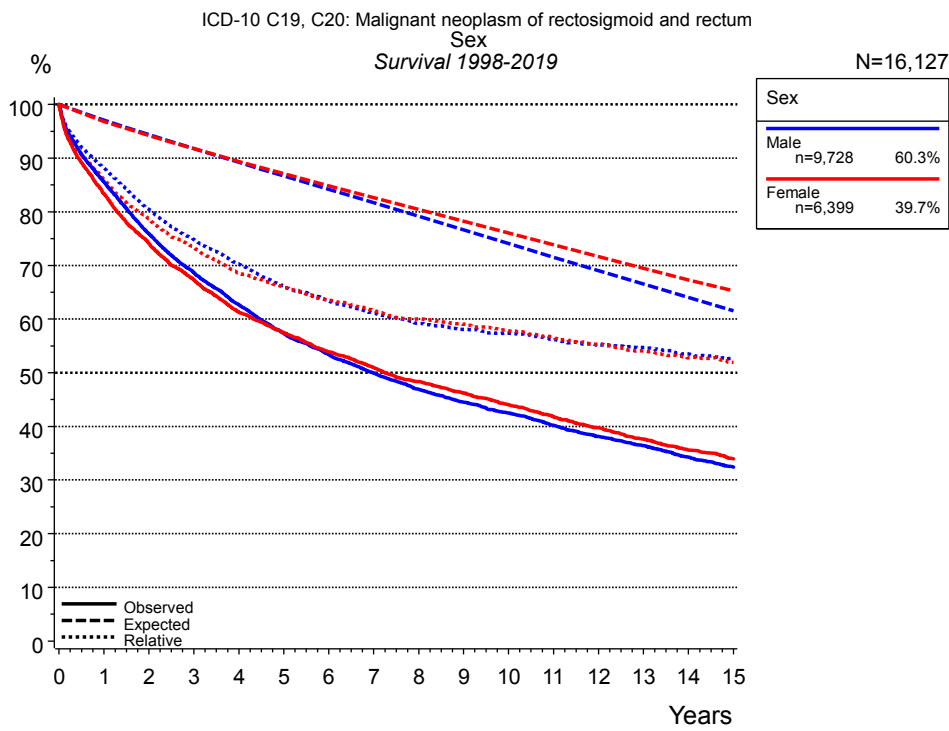
**Figure 1a.** Relative survival of patients with rectal cancer by period of diagnosis. Included in the evaluation are 19,566 cases diagnosed between 1988 and 2019.

The survival results of the SEER program (Surveillance, Epidemiology, and End Results) of the American National Cancer Institute (NCI) are summarized as the period of diagnosis from 2000 to 2017, and are represented by colored diamonds in order to facilitate comparisons between MCR and SEER.

The presented survival curves are derived from clinical records with valid follow-up informations, which means that death certificate cases (DCO) cases are omitted from the analysis. With this one restriction, the MCR has provided population-based statistics since 1998, collecting data on all cancer cases in the region of southern Bavaria. Historical data of previous time periods can be heavily selected, therefore, univariate survival comparisons of the presented time periods must be carefully considered. Nonetheless, all calculable survival curves are depicted to facilitate the comparison of long time follow-up analyses of relative survival between particular cancers.

Years	Period of diagnosis					
	1988-1997 n=3,439		1998-2006 n=6,255		2007+ n=9,872	
	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %
0	100.0	100.0	100.0	100.0	100.0	100.0
1	85.2	88.0	84.9	87.7	84.5	87.1
2	73.9	78.7	75.0	79.7	75.4	79.8
3	65.7	72.1	67.9	74.1	68.3	74.3
4	59.6	67.4	61.7	69.3	62.5	69.8
5	54.0	63.0	56.9	65.7	57.8	66.4
6	49.0	59.0	52.8	62.7	54.3	64.2
7	45.4	56.4	49.8	60.9	50.7	61.7
8	42.8	54.8	46.9	59.0	47.9	60.0
9	40.5	53.5	44.6	57.9	45.7	59.1
10	38.4	52.4	42.5	56.8	43.8	58.4
11	36.3	51.1	40.3	55.7	41.3	57.0
12	34.4	50.1	38.2	54.6	39.7	56.4
13	32.6	49.0	36.4	53.7		
14	30.7	47.6	34.3	52.4		
15	29.3	47.1	32.5	51.6		
Median	5.8		6.9		7.2	

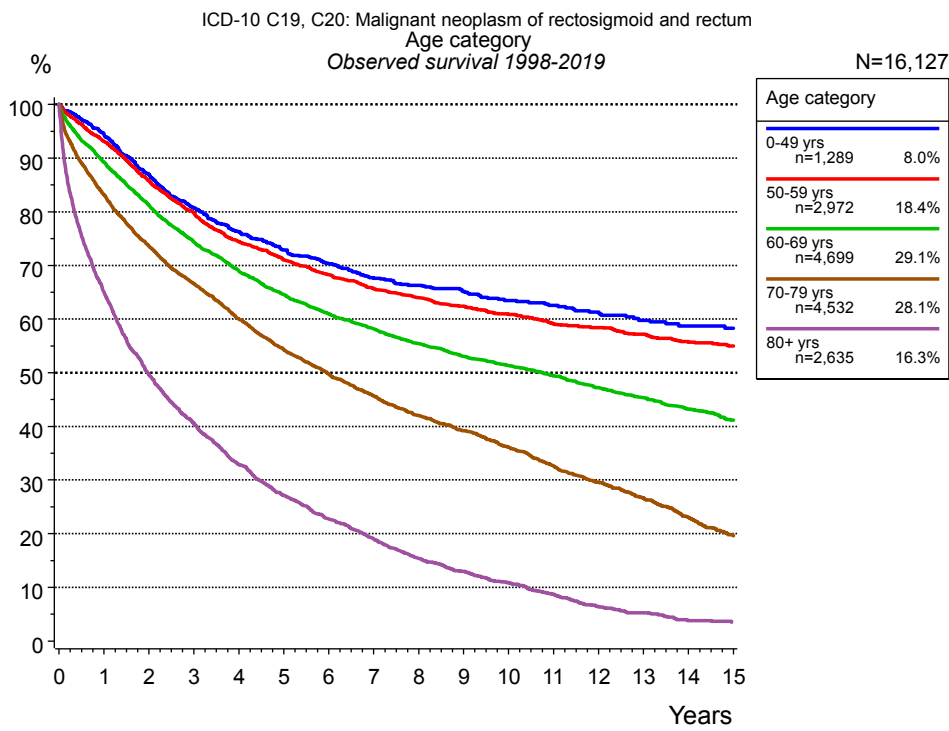
**Table 1b.** Observed (obs.) and relative (rel.) survival of patients with rectal cancer by period of diagnosis for period 1988-2019 (N=19,566).



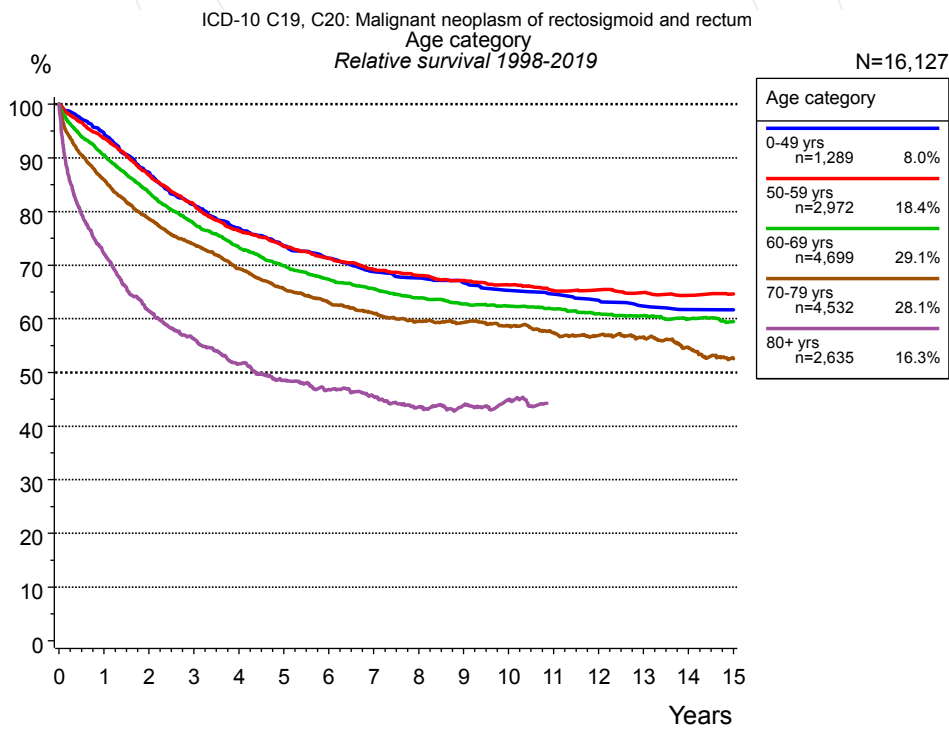
**Figure 2a.** Survival of patients with rectal cancer by sex. Included in the evaluation are 16,127 cases diagnosed between 1998 and 2019.

Years	Sex			
	Male n=9,728		Female n=6,399	
	obs. %	rel. %	obs. %	rel. %
0	100.0	100.0	100.0	100.0
1	85.6	88.2	83.3	86.1
2	75.9	80.4	74.1	78.7
3	68.7	74.8	67.3	73.3
4	62.7	70.2	61.2	68.5
5	57.3	66.1	57.4	65.9
6	53.4	63.4	53.9	63.5
7	49.9	61.1	51.0	61.6
8	46.9	59.2	48.3	60.1
9	44.5	58.1	46.2	59.0
10	42.5	57.3	44.0	57.8
11	40.2	56.2	41.8	56.6
12	38.1	55.2	39.7	55.4
13	36.4	54.7	37.6	54.1
14	34.2	53.4	35.5	52.8
15	32.4	52.6	33.9	52.0
Median	7.0		7.2	

**Table 2b.** Observed (obs.) and relative (rel.) survival of patients with rectal cancer by sex for period 1998-2019 (N=16,127).



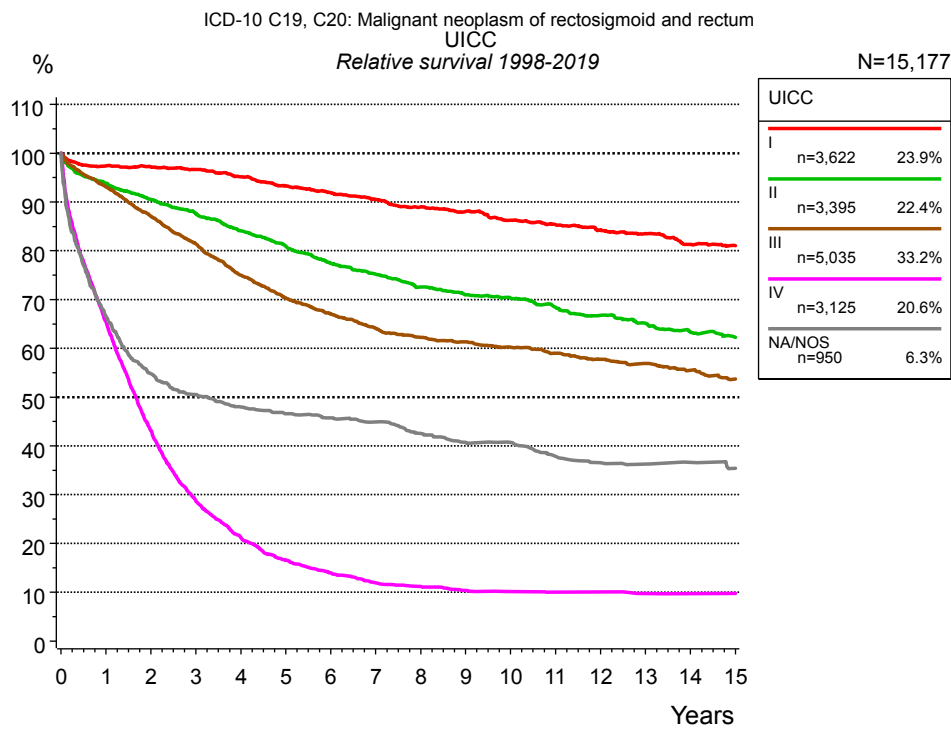
**Figure 3a.** Observed survival of patients with rectal cancer by age category. Included in the evaluation are 16,127 cases diagnosed between 1998 and 2019.



**Figure 3b.** Relative survival of patients with rectal cancer by age category. Included in the evaluation are 16,127 cases diagnosed between 1998 and 2019.

Years	Age category									
	0-49 yrs n=1,289		50-59 yrs n=2,972		60-69 yrs n=4,699		70-79 yrs n=4,532		80+ yrs n=2,635	
	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1	94.4	94.6	93.1	93.6	89.3	90.5	83.2	85.9	65.0	72.2
2	87.0	87.3	85.7	86.8	81.2	83.6	73.6	78.7	49.7	61.5
3	80.8	81.2	79.8	81.3	74.4	77.7	66.6	73.9	40.5	56.2
4	76.3	76.9	74.4	76.4	69.0	73.3	60.0	69.3	32.9	51.6
5	72.9	73.6	71.0	73.5	64.6	69.9	54.3	65.6	27.1	48.5
6	70.3	71.3	68.2	71.3	61.0	67.3	49.7	63.0	22.7	46.8
7	67.6	68.8	65.6	69.2	58.2	65.6	45.6	61.0	19.0	45.5
8	66.3	67.6	63.9	68.1	55.4	63.9	42.0	59.5	15.4	43.6
9	65.2	66.7	62.4	67.1	53.0	62.7	39.2	59.3	12.9	43.9
10	63.5	65.3	60.8	66.3	51.3	62.4	36.1	58.7	10.9	45.0
11	62.6	64.6	59.2	65.3	49.4	61.8	32.6	57.4	8.7	44.5
12	61.3	63.5	58.4	65.4	47.2	60.9	29.5	56.9	6.4	41.5
13	59.8	62.4	57.1	64.9	45.3	60.6	26.7	56.6	5.3	43.8
14	58.7	61.7	55.7	64.4	43.2	60.0	23.1	54.6	3.8	43.0
15	58.3	61.7	55.0	64.6	41.2	59.5	19.6	52.6		
Median			19.4		10.8		6.0		2.0	

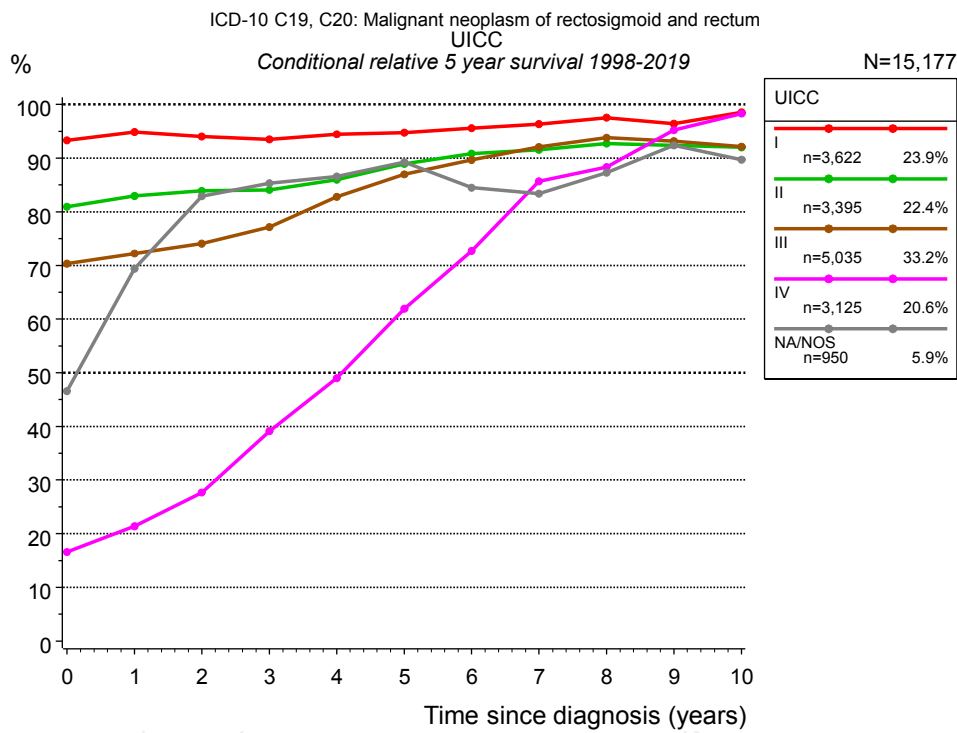
**Table 3c.** Observed (obs.) and relative (rel.) survival of patients with rectal cancer by age category for period 1998-2019 (N=16,127).



**Figure 4a.** Relative survival of patients with rectal cancer by UICC. For 15,278 of 16,127 cases diagnosed between 1998 and 2019 valid data could be obtained for this item. For a total of 15,177 cases an evaluable classification was established. The grey line represents the subgroup of 950 patients with missing values regarding UICC (5.9 % of 16,127 patients, the percent values of all other categories are related to n=15,177).

Years	UICC									
	I n=3,622		II n=3,395		III n=5,035		IV n=3,125		NA/NOS n=950	
	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1	94.6	97.4	90.8	93.8	90.7	93.1	63.7	65.4	62.8	66.5
2	91.7	97.2	84.8	90.5	82.7	87.1	41.1	43.2	49.5	54.8
3	88.4	96.7	79.6	87.6	75.5	81.4	26.8	28.7	44.2	50.5
4	84.5	95.2	74.2	84.1	67.8	75.0	19.5	21.3	40.7	47.9
5	80.3	93.3	69.2	80.9	62.1	70.3	14.9	16.6	38.5	46.6
6	76.7	91.9	64.2	77.4	57.8	67.0	12.3	14.0	36.9	45.7
7	73.2	90.5	60.4	75.2	53.9	64.1	10.3	11.9	35.3	44.9
8	69.7	89.0	56.5	72.6	50.9	62.2	9.5	11.2	32.6	42.6
9	66.7	88.1	53.5	71.0	48.9	61.3	8.6	10.3	30.5	40.7
10	63.1	86.3	51.2	70.3	46.7	60.2	8.2	10.1	29.6	40.7
11	60.2	85.4	48.2	68.5	44.4	59.0	7.9	10.0	26.8	37.8
12	57.4	84.3	45.4	66.7	42.2	57.7	7.8	10.1	25.1	36.5
13	54.9	83.6	42.7	65.1	40.3	56.9	7.3	9.7	24.5	36.3
14	51.4	81.3	40.0	63.3	38.1	55.5	7.1	9.7	24.0	36.6
15	49.3	81.1	37.9	62.2	35.7	53.7	7.1	9.7	22.5	35.4
Median	14.7		10.5		8.4		1.6		1.9	

**Table 4b.** Observed (obs.) and relative (rel.) survival of patients with rectal cancer by UICC for period 1998-2019 (N=15,177).



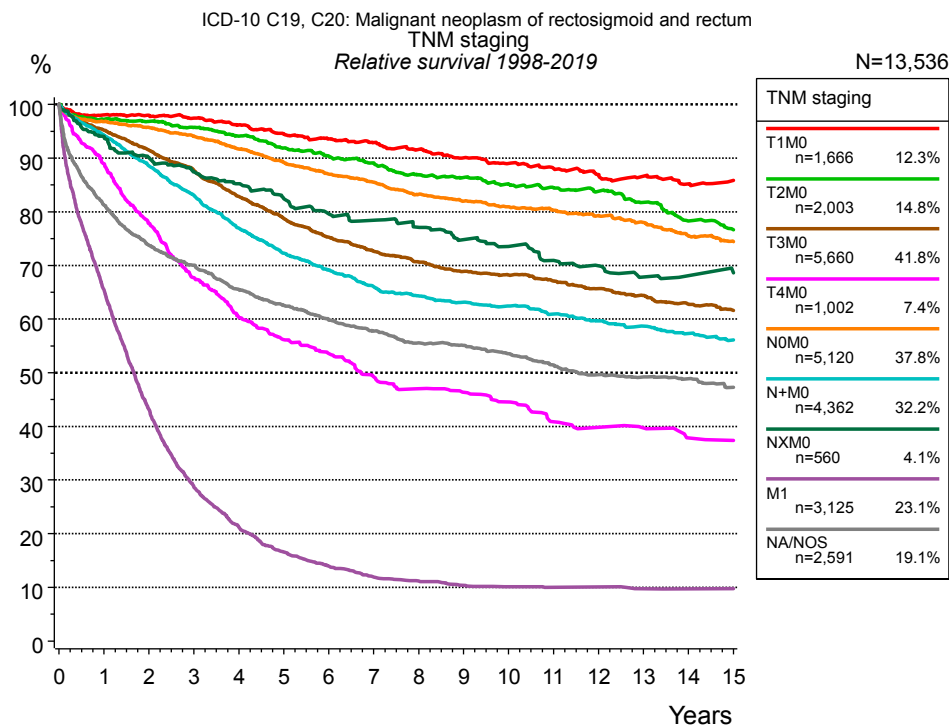
**Figure 4c.** Conditional relative 5-year survival of patients with rectal cancer by UICC. For 15,278 of 16,127 cases diagnosed between 1998 and 2019 valid data could be obtained for this item. For a total of 15,177 cases an evaluable classification was established. The grey line represents the subgroup of 950 patients with missing values regarding UICC (5.9 % of 16,127 patients, the percent values of all other categories are related to n=15,177).

Years	UICC									
	I		II		III		IV		NA/NOS	
	n	Cond. surv. % 5 yrs	n	Cond. surv. % 5 yrs	n	Cond. surv. % 5 yrs	n	Cond. surv. % 5 yrs	n	Cond. surv. % 5 yrs
0	3,622	93.3	3,395	80.9	5,035	70.3	3,125	16.6	950	46.6
1	3,239	94.8	2,947	82.9	4,355	72.2	1,871	21.4	563	69.4
2	3,016	94.0	2,649	83.9	3,753	74.1	1,141	27.7	431	82.9
3	2,785	93.5	2,376	84.1	3,214	77.1	695	39.1	366	85.3
4	2,512	94.4	2,113	86.0	2,699	82.8	467	49.0	325	86.6
5	2,250	94.7	1,864	88.9	2,285	87.0	324	61.9	296	89.2
6	2,013	95.6	1,595	90.9	1,944	89.7	247	72.7	274	84.5
7	1,788	96.3	1,408	91.6	1,651	92.1	182	85.7	252	83.4
8	1,572	97.5	1,214	92.7	1,387	93.8	148	88.3	217	87.3
9	1,366	96.4	1,060	92.4	1,175	93.2	113	95.2	187	92.4
10	1,187	98.5	921	92.0	990	92.2	89	98.3	173	89.7

**Table 4d.** Conditional relative 5-year survival of patients with rectal cancer by UICC for period 1998-2019 (N=15,177).

Conditional relative survival rates refer to the relative survival probability, in this case for 5 years after cancer diagnosis, compared to the age- and sex-matched population (=100 %) under the condition of being alive for a certain time period (x-axis in Figure 4a). The results illustrate to what extent the cancer induced mortality of particular subgroups declines in the subsequent years after detection of the malignancy. For instance, according to the presented survival statistics, patients in the subgroup UICC="I", who are alive at least 3 years after cancer diagnosis, the conditional relative 5-year survival rate is 93.5% (n=2,785).



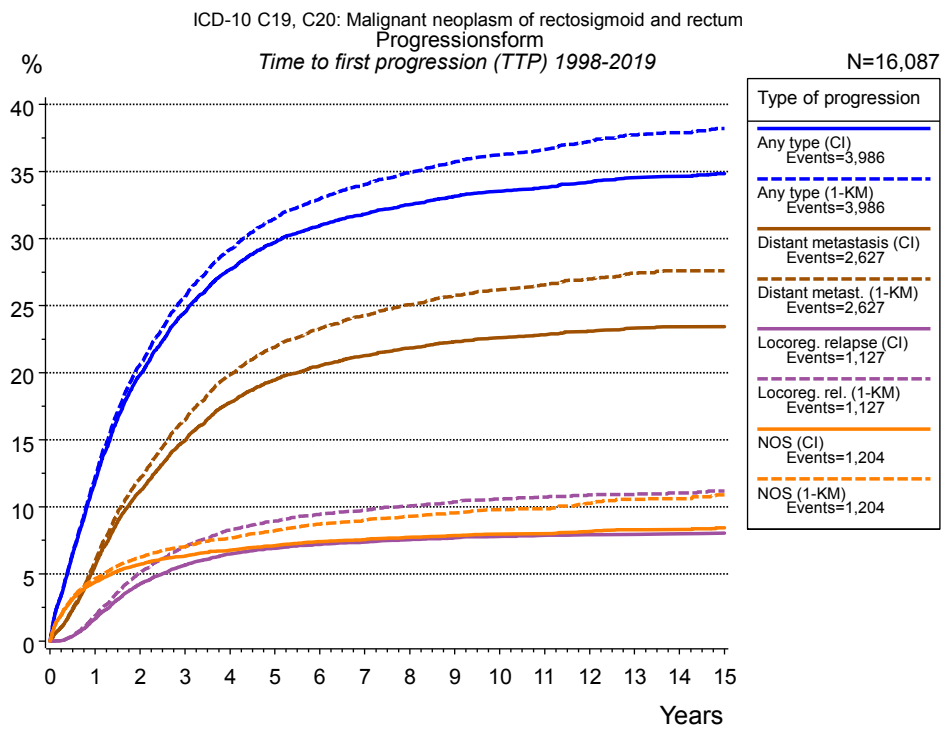


**Figure 4g.** Relative survival of patients with rectal cancer by TNM staging. For 15,278 of 16,127 cases diagnosed between 1998 and 2019 valid data could be obtained for this item. For a total of 13,536 cases an evaluable classification was established. The accumulated percentage exceeds the 100 % value because patients are potentially considered in more than one subgroup. The grey line represents the subgroup of 2,591 patients with missing values regarding TNM staging (16.1 % of 16,127 patients, the percent values of all other categories are related to n=13,536).

Years	TNM staging													
	T1M0 n=1,666		T2M0 n=2,003		T3M0 n=5,660		T4M0 n=1,002		NOM0 n=5,120		N+M0 n=4,362		NXM0 n=560	
	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %	obs. %	rel. %
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1	95.7	98.1	94.4	97.2	92.5	95.2	86.4	88.9	93.9	96.8	91.9	94.2	91.4	94.0
2	93.3	98.0	91.1	96.8	86.5	91.5	73.6	77.9	90.2	95.7	84.3	88.6	85.1	90.1
3	90.4	97.5	87.5	95.7	80.8	87.7	62.5	67.7	86.1	94.0	77.2	83.1	80.3	87.4
4	86.9	96.2	83.5	94.1	74.2	82.8	54.3	60.3	81.5	91.7	69.8	76.9	76.4	85.2
5	83.1	94.5	79.1	91.9	68.6	78.7	49.3	56.2	76.9	89.3	64.0	72.3	71.8	82.4
6	80.0	93.6	75.5	90.4	63.9	75.3	46.0	53.6	72.8	87.0	59.9	69.1	67.7	79.6
7	77.2	92.9	72.2	89.1	60.0	72.6	41.2	49.2	69.3	85.5	55.8	66.0	65.0	78.4
8	73.9	91.6	68.1	86.9	56.7	70.6	38.3	47.0	65.4	83.3	52.9	64.3	62.3	77.1
9	70.3	90.1	65.6	86.4	53.6	68.8	36.8	46.4	62.3	82.0	50.7	63.2	58.6	74.8
10	67.2	89.0	62.6	85.2	51.5	68.2	34.6	44.6	59.5	80.9	48.7	62.4	55.8	73.5
11	64.3	88.1	60.1	84.5	49.2	67.1	30.8	40.9	57.1	80.3	46.2	60.9	52.4	70.9
12	61.3	86.9	57.6	83.8	46.6	65.7	29.3	39.8	54.4	79.3	44.0	59.7	49.9	69.9
13	58.9	86.6	54.3	81.7	44.1	64.4	28.5	39.7	51.7	78.0	42.0	58.7	46.8	67.9
14	55.7	85.2	50.1	78.3	41.5	62.7	26.2	37.9	48.1	75.5	39.7	57.3	45.4	68.1
15	53.9	85.9	47.4	76.6	39.3	61.6	25.6	37.4	45.7	74.4	37.7	56.1	44.3	68.6
Median	16.4		14.1		10.7		4.9		13.4		9.2		11.9	

<i>cont'd</i>	TNM staging			
	M1 n=3,125		NA/NOS n=2,591	
	obs. %	rel. %	obs. %	rel. %
Years				
0	100.0	100.0	100.0	100.0
1	63.7	65.4	77.7	81.2
2	41.1	43.2	68.0	73.7
3	26.8	28.7	62.5	70.0
4	19.5	21.3	56.7	65.5
5	14.9	16.6	52.5	62.6
6	12.3	14.0	48.6	59.8
7	10.3	11.9	45.5	57.8
8	9.5	11.2	42.4	55.6
9	8.6	10.3	40.7	55.1
10	8.2	10.1	38.3	53.5
11	7.9	10.0	35.5	51.4
12	7.8	10.1	33.1	49.7
13	7.3	9.7	31.8	49.2
14	7.1	9.7	30.5	48.9
15	7.1	9.7	28.5	47.3
Median	1.6		5.7	

**Table 4h.** Observed (obs.) and relative (rel.) survival of patients with rectal cancer by TNM staging for period 1998-2019 (N=13,536).

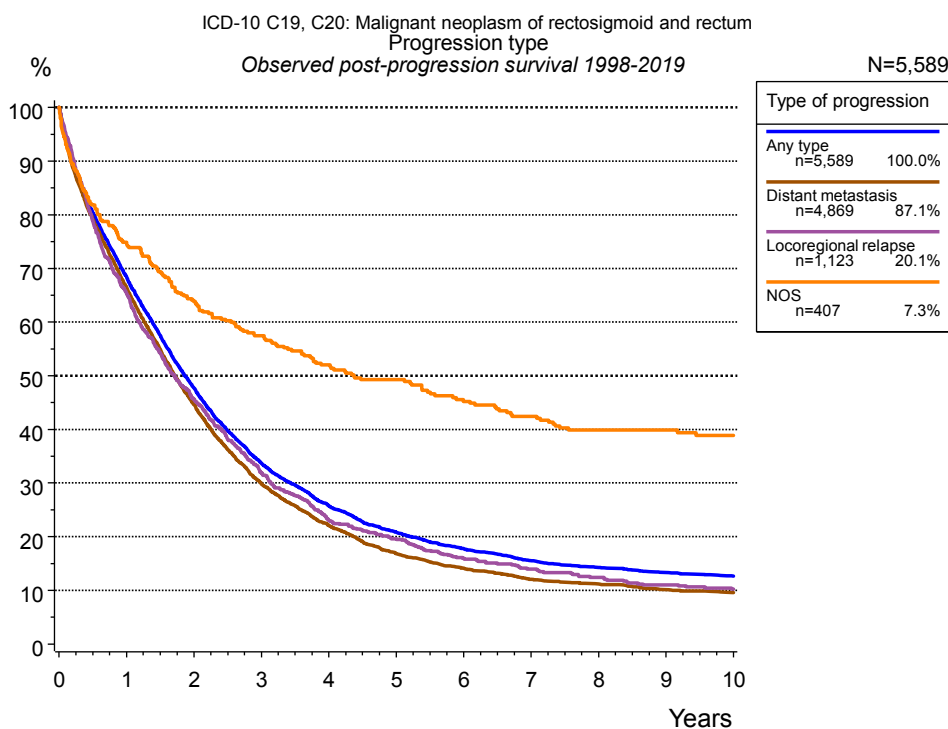


**Figure 5a.** Time to first progression of 16,087 patients with rectal cancer diagnosed between 1998 and 2019 (in solid cancers M0 only) estimated by cumulative incidence function (CI, solid line) accounting for death as competing risk and by inverse Kaplan-Meier estimate (1-KM, dashed line). The frequency of events may be underestimated due to underreporting.

	Type of progression							
	Any type (CI)	Any type (1-KM)	Distant metastasis (CI)	Distant metast. (1-KM)	Locoreg. relapse (CI)	Locoreg. rel. (1-KM)	NOS (CI)	
N	13,025	13,025	13,026	13,026	16,087	16,087	16,086	
Events	3,970	3,970	2,624	2,624	1,120	1,120	1,196	
compet.	2,524		3,580		7,397		7,256	
Years	%	%	%	%	%	%	%	%
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11.9	12.2	5.6	5.9	1.7	1.9	4.4	
2	19.8	20.6	11.2	12.1	4.3	5.1	5.7	
3	24.5	25.6	14.9	16.4	5.6	7.0	6.3	
4	27.7	29.2	17.8	19.8	6.5	8.3	6.8	
5	29.7	31.5	19.4	21.9	6.9	8.9	7.1	
6	31.0	33.0	20.5	23.3	7.2	9.4	7.4	
7	31.8	34.0	21.3	24.3	7.4	9.8	7.6	
8	32.5	34.9	21.8	25.1	7.5	10.1	7.7	
9	33.2	35.7	22.3	25.8	7.7	10.4	7.9	
10	33.5	36.3	22.6	26.2	7.8	10.6	8.0	
11	33.8	36.6	22.8	26.5	7.9	10.7	8.0	
12	34.2	37.2	23.1	27.0	7.9	10.9	8.2	
13	34.5	37.7	23.3	27.4	8.0	10.9	8.3	
14	34.6	37.9	23.4	27.6	8.0	11.0	8.3	
15	34.8	38.2	23.4	27.6	8.1	11.2	8.4	

Type of progression	
<i>cont'd</i>	NOS (1-KM)
N	16,086
Events	1,196
compet.	
Years	%
0	0.0
1	4.6
2	6.2
3	7.0
4	7.7
5	8.2
6	8.7
7	9.0
8	9.3
9	9.6
10	9.8
11	9.9
12	10.3
13	10.6
14	10.6
15	10.9

**Table 5b.** Time to first progression of patients with rectal cancer for period 1998-2019 (N=16,087), also showing the total of progression events (Events) and of deaths as competing risk (compet.).

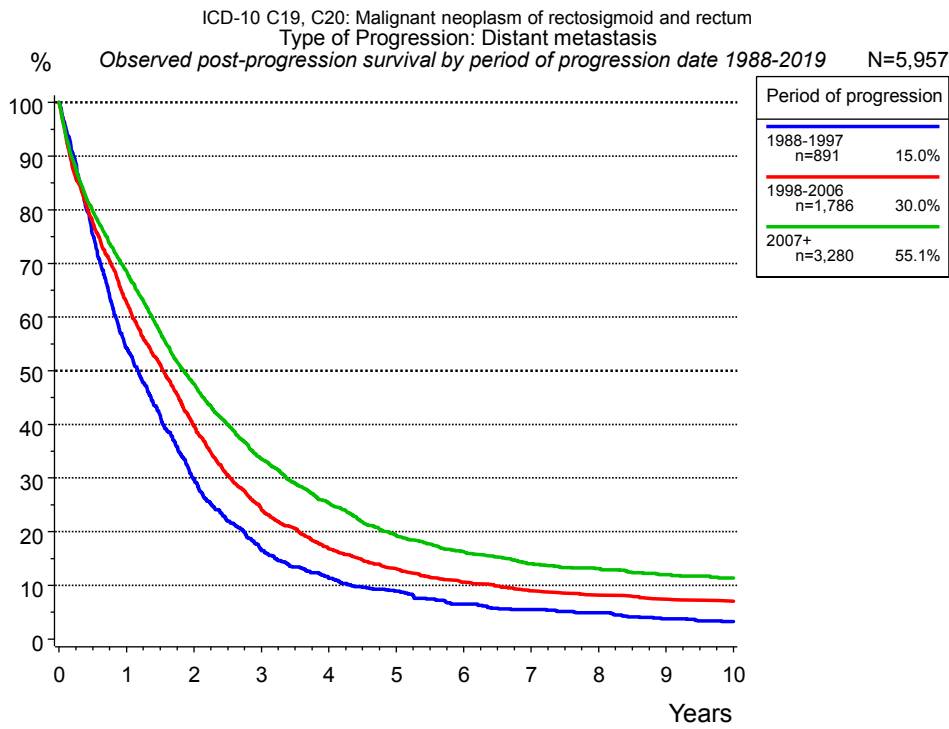


**Figure 5c.** Observed post-progression survival of 5,589 patients with rectal cancer diagnosed between 1998 and 2019. These 5,589 patients with documented progression events during their course of disease represent 34.7 % of the totally 16,087 evaluated cases (incl. M1, n=3,062, 19.0 %). Patients with cancer relapse documented via death certificates only were excluded (n=1,459, 9.1 %). Multiple progression types on different sites are included in the evaluation even when not occurring synchronously. The NOS (not otherwise specified) class is included under the condition, that it is the one and only progression type during the course of disease.

Medical record documentation often lacks the linguistic severity to distinguish between local relapse, regional lymph node metastasis and distant spread in solid cancers. Frequently, the statement “not specified” is the only information in registries regarding relapse of the disease. The category “Any type” denotes all cases who suffered from at least one relapse during the course of disease (incl. primary M1-status). Although, the real number of relapsed patients is likely to be much higher. The accumulated percentage of patients with local relapse or distant metastasis exceeds the 100 % value because patients are potentially considered in more than one subgroup.

Years	Type of progression			
	Any type n=5,589 %	Distant metastasis n=4,869 %	Locoregional relapse n=1,123 %	NOS n=407 %
0	100.0	100.0	100.0	100.0
1	68.4	66.5	65.3	74.9
2	47.7	44.6	45.6	63.8
3	33.7	29.9	32.0	57.4
4	25.8	22.1	23.1	52.0
5	20.8	16.9	19.6	49.3
6	17.8	14.1	16.0	45.2
7	15.5	12.1	14.0	42.4
8	14.3	11.2	12.4	39.9
9	13.3	10.1	11.0	39.9
10	12.6	9.6	10.2	38.9

**Table 5d.** Observed post-progression survival of patients with rectal cancer for period 1998-2019 (N=5,589).



**Figure 5e.** Observed post-progression (distant metastasis) survival of 5,957 patients with rectal cancer diagnosed between 1988 and 2019 by period of progression.

Years	Period of progression		
	1988-1997 n=891 %	1998-2006 n=1,786 %	2007+ n=3,280 %
0	100.0	100.0	100.0
1	54.2	62.7	68.5
2	29.8	39.6	47.6
3	16.6	24.2	33.6
4	11.3	16.8	25.4
5	8.9	13.1	19.3
6	6.5	10.6	16.3
7	5.5	9.0	14.0
8	4.9	8.2	13.1
9	3.8	7.4	12.0
10	3.3	7.1	11.3

**Table 5f.** Observed post-progression (distant metastasis) survival of patients with rectal cancer for period 1988-2019 by period of progression (N=5,957).

## Shortcuts

MCR Munich Cancer Registry, Germany

NCI National Cancer Institute, USA

SEER Surveillance, Epidemiology, and End Results, USA

UICC Union for International Cancer Control, Geneva

DCO Death certificate only Death certificate provides the only notification to the registry.

NA Not available

NOS Not otherwise specified

OS Overall/Observed survival Overall/Observed survival (Kaplan-Meier estimate)  
Date of entry: diagnosis  
Event: death from any cause

RS Relative survival Survival compared to “general population”,  
ratio of observed to expected survival (Ederer II method),  
reflecting cancer specific survival

AS Assembled survival Assembled chart of  
observed, expected, relative survival

CS Conditional survival Survival probability under the condition of surviving  
a given period of time

TTP Time to progression Time to first progression / relapse  
Date of entry: diagnosis  
Event: (progression / relapse): first local-, lymph node recurrence,  
distant metastasis or unspecified progression

1-KM 1 minus Kaplan-Meier estimator  
 (“inverse” Kaplan-Meier estimator)

CI Cumulative incidence  
Death as competing risk (according to Kalbfleisch und Prentice)

PPS Post-progression survival Survival since first progression / relapse (Kaplan-Meier estimate)  
Date of entry (progression / relapse): first local-, lymph node  
recurrence, distant metastasis or unspecified progression  
Event: death from any cause

## Recommended Citation

Munich Cancer Registry. Survival ICD-10 C19, C20: Rectal cancer [Internet]. 2021 [updated 2021 Jan 27; cited 2021 Mar 1]. Available from: <https://www.tumorregister-muenchen.de/en/facts/surv/sC1920E-ICD-10-C19-C20-Rectal-cancer-survival.pdf>

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